



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B01L 3/00, G01N 33/53	A1	(11) International Publication Number: WO 93/09872
		(43) International Publication Date: 27 May 1993 (27.05.93)

(21) International Application Number: PCT/NL92/00213

(22) International Filing Date: 20 November 1992 (20.11.92)

(30) Priority data:
9101953 21 November 1991 (21.11.91) NL

(71) Applicants (for all designated States except US): SEED CAPITAL INVESTMENTS (SCI) B.V. [NL/NL]; Bernadottelaan 15, NL-3527 GA Utrecht (NL). CENTRAAL DIERGENEESKUNDIG INSTITUUT [NL/NL]; Edelhertweg 15, NL-8219 PH Lelystad (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): PUIJK, Wouter, Cornelis [NL/NL]; Schoener 43-40, NL-8243 VZ Lelystad (NL). LIGTVOET, Gerard, Cornelis [NL/NL]; Van 's-Gravensandestraat 37, NL-2321 EP Leiden (NL). MELOEN, Robert, Hans [NL/NL]; Karveel 10-04, NL-8231 AP Lelystad (NL).

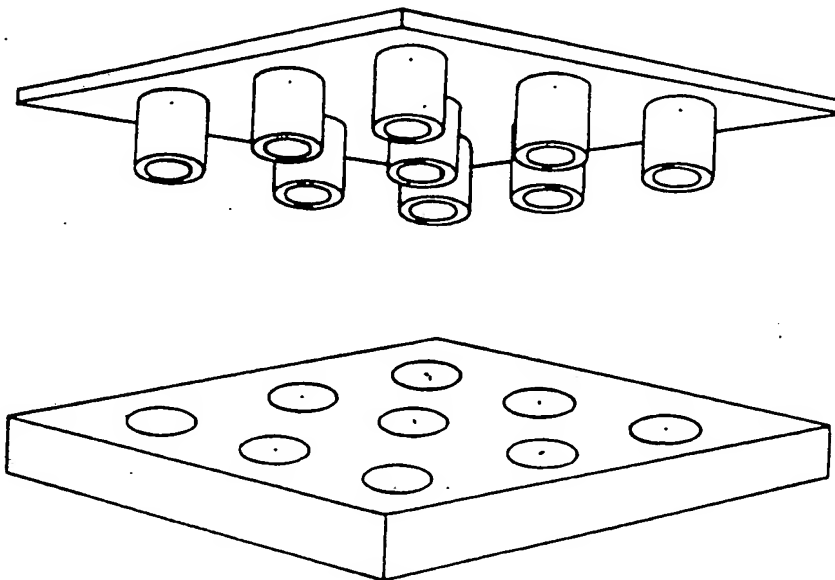
(74) Agents: DE BRUIJN, Leendert, C. et al.; Nederlandsch Octrooibureau, Scheveningseweg 82, P.O. Box 29720, NL-2505 LS The Hague (NL).

(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CS, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, PL, RO, RU, SD, SE, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published

*With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: TEST DEVICE COMPRISING A PLATE CONTAINING A MULTIPLICITY OF WELLS WITH AN ASSOCIATED METERING DEVICE, AS WELL AS A KIT WHICH COMPRISES THESE DEVICES AND USE OF THE DEVICES



(57) Abstract

The invention relates to a test device comprising a plate containing a multiplicity of wells. The invention also relates to a metering device suitable for simultaneously introducing equal volumes of reagent into different wells of the test device. The test device comprises wells which have a volume within the range of 0.1-20 μ l. The ratio between the depth of the wells and the diameter is preferably less than 1:1. The test device according to the invention can be used for carrying out a bio- or immuno-chemical test such as a pepscan or ELISA.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NL	Netherlands
BE	Belgium	GN	Guinea	NO	Norway
BF	Burkina Faso	GR	Greece	NZ	New Zealand
BG	Bulgaria	HU	Hungary	PL	Poland
BJ	Benin	IE	Ireland	PT	Portugal
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SK	Slovak Republic
CI	Côte d'Ivoire	LJ	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	MC	Monaco	TG	Togo
DE	Germany	MG	Madagascar	UA	Ukraine
DK	Denmark	ML	Mali	US	United States of America
ES	Spain	MN	Mongolia	VN	Viet Nam
FI	Finland				

Test device comprising a plate containing a multiplicity of wells with an associated metering device, as well as a kit which comprises these devices and use of the devices.

The present invention relates to a test device comprising a plate
5 containing a multiplicity of wells. The invention also relates to a
metering device suitable for the simultaneous introduction of equal volumes
of reagent into different wells of the test device. In addition, the inven-
tion relates to a method for carrying out a (bio- and/or immuno) chemical
test using the test device and/or the metering device and the invention is
10 aimed at a kit which comprises the test device and the metering device.

A test device comprising a plate containing a multiplicity of wells
has already been known for years in the form of the so-called microtitre
plate. The known microtitre plate is of the order of 12.5 cm \times 8.0 cm in
size and comprises 96 wells. The diameter of each well is about 0.6 cm and
15 the depth of each well is about 1.0 cm, so that each well can contain at
most a 250 μ l sample. The wells are separated by material barriers with a
width of approximately 2.0 mm.

The known microtitre plate is used when carrying out diverse bio-
and/or immunochemical tests. In tests of this type, photometric detection
20 is frequently used. A very well-known example of such a test is the ELISA.
In the case of photometric determinations, the bottom of a well must be
uniformly covered with a layer of the sample to be analysed in order to
obtain reliable results. Furthermore, this layer must have a thickness
which is at least such that detectable absorption occurs. In practice, this
25 generally implies that samples are used which have at least a volume of
50 μ l.

Since bio- and/or immunochemical tests frequently involve large
numbers of tests on samples (such as blood and sera) which have to be
obtained from test persons and/or animals, there is a need to use as little
30 sample as possible per test.

However, the sample can be diluted to only a limited degree since
the component to be analysed must also be present in the well in a certain
minimum concentration in order to obtain measurable absorption. This is
because, according to Lambert-Beers' law, the light intensity is dependent
35 on the concentration and the absorption coefficient of the component to be
analysed and also on the distance the light has to travel through the
sample to be measured. In practice, this implies the use of about 12.5 ml

of reagents per microtitre plate. In such cases there is an appreciable need to reduce the amount of sample to be used.

Another frequent use of the current microtitre plate is in the synthesis of peptides. In such syntheses peptides containing different amino acid sequences can be synthesised. This can be carried out, for example, with a view to determining the location of an epitope of a protein for a specific antibody. To this end, peptides containing amino acid sequences corresponding to a fragment of the protein to be studied are synthesised separately. The synthesis can be carried out in such a way that each peptide in part contains the amino acid sequence of another peptide. It is even possible to carry out the synthesis in such a way that only one amino acid does not overlap. It is also possible to produce a series of short sections, for example hexapeptides which overlap with the exception of one amino acid. A determination is then carried out to establish with which peptide antibody binding takes place. Peptides with which antibody binding takes place contain an epitope.

In the first instance, peptide synthesis was carried out by adding the amino acid to be coupled to the well of the known microtitre plate in which the peptide had to be synthesised, then coupling the desired amino acid to the growing peptide chain, subsequently washing the well to remove any unreacted amino acid and repeating the procedure with the next amino acid.

However, with this method problems were experienced in rinsing the wells and, therefore, a method of peptide synthesis was adopted in which small polyethylene rods are used as supports for the growing peptide chains. This method is described by Geysen, H.M., Meloen, R.H. and Barteling, S.J. beschreven in Proc. Natl. Acad. Sci. USA, Vol. 81 (July 1984) pp. 3998-4002. In this article, a method is described for the simultaneous synthesis of hundreds of peptides on a solid support with adequate purity for carrying out an ELISA. Interaction of the peptides with antibodies can be detected simply, without removing the peptides from the support. Consequently, it becomes possible to determine an immunogenic epitope with a good resolution. This method is termed the PEPSCAN.

With this method, the growing peptide chains are allowed to adhere to polyethylene rods (having a diameter of 4 mm and a length of 40 mm) and the reactions required for peptide synthesis are then carried out using the ends of the support rods. To this end, the polyethylene rods are first immersed in a 6 percent solution of acrylic acid in water and subjected to γ -radiation. For the subsequent reactions, the ends of the rods are then

brought into contact with a Teflon plate containing a matrix of wells corresponding to the location of the rods (the known microtitre plate). The conventional methods for peptide chemistry in the solid phase can be used here, for example for coupling N^t -t-butyloxycarbonyl-L-lysine methyl ester to polyethylene/polyacrylic acid via the N^t -amino group of the side chain. [(Erickson, B.W. and Merrifield, R.B. (1976) in *The Proteins*, Eds. Neurath, H & Hill, R.L. (Academic, New York), Vol. 2, pp. 255-527) and (Meienhofer, J. (1973) in *Hormonal Proteins and Peptides*, Ed. Li, C.H., (Academic, New York), Vol. 2, pp. 45-267)]. After removing the t-butyloxycarbonyl group, t-butyloxycarbonyl-L-alanine can be coupled, a peptide-like spacer being formed. The desired amino acids can be coupled successively and, following the final desired coupling reaction and after removal of the protecting t-butyloxycarbonyl group, the terminal amino acid can be acetylated using acetic anhydride in dimethylformamide/triethylamine. All coupling reactions carried out with N,N-dicyclohexylcarbodiimide can be carried out in dimethylformamide in the presence of N-hydroxybenzotriazole. Any protective groups in side chains of amino acids used in the peptide synthesis can also be removed. Before the synthesised peptides are examined further, for example by means of ELISA, the rods can be washed with a phosphate-buffered saline solution.

Another use of peptide synthesis takes place if one or more amino acids of a known epitope are changed in order to determine which other sequences are able to function as an epitope and/or in order to determine which amino acids are essential for the epitope action. A method of this type is described by Geysen, H.M., Meloen, R.H. and Barteling, S.J. in *Proc. Natl. Acad. Sci. USA*, Vol. 82 (January 1985) pp. 178-182.

As such methods frequently comprise a large number of syntheses and thus also the use of large amounts of reagents, which reagents, moreover, are frequently expensive, there is also a need, with a view to reducing costs, to use sample amounts which are as small as possible. Possibilities have therefore been sought for miniaturisation of such peptide syntheses.

A method for miniaturised peptide synthesis has recently been described in an article by Fodor, S.P.A. et al. (*Science*, (15 February 1991) pp. 767-773). In this method light is used to control the simultaneous synthesis of a large number of different chemical compounds. Synthesis takes place on a solid support, such as a glass plate. The support is aminated by treatment with 0.1 % aminopropyltriethoxysilane in 95 % ethanol. Here, a light-sensitive protective group is then introduced, said protective group disappearing following irradiation with light and giving

a reactive site to which a building block, such as an amino acid, can be coupled. The pattern in which exposure to light or other forms of energy takes place (for example via a mask) determines which areas of the support are activated for chemical coupling. The entire surface is brought into
5 contact with the building block to be coupled (said building block also being provided with a light-sensitive protective group). A coupling reaction will occur only at sites where the light in the previous step has given rise to activation. The substrate is then exposed through another mask, so that a subsequent building block can be incorporated in the
10 desired site. The pattern of the mask and the sequence of the reagents determine the sequences of the peptides formed. A high degree of miniaturisation can be achieved in this way. For example, it is possible to synthesise 40,000 different peptides on 1 cm².

However, this method has a number of disadvantages. The removal of
15 the protective light-sensitive group (nitroveratryloxycarbonyl is named in the article) takes place by irradiation for 20 minutes with a mercury lamp having a power of 12 mW/cm³. This will result in a very long synthesis time in the case of the synthesis of longer peptides. Furthermore, a different mask will have to be used for each addition step and a different set of
20 masks will have to be used for each series of peptides.

Moreover, only one building block can be added in each addition step because the various peptides to be synthesised are not spatially separated. It is obvious that mixing of reagents would otherwise take place and, thus, undesired products would also form. This method is therefore very labori-
25 ous, especially for the synthesis of peptides which differ not only in respect of length but also in respect of sequence.

The authors of the article themselves also touch on the problem of the reliability of the synthesis. Deletions can occur as a consequence of incomplete removal of the protective group, following irradiation with
30 light. The net coupling percentage is 85-95 %. Furthermore, when changing masks, a certain overlap between the diverse synthesis regions will take place because of light diffraction, internal reflection and scattering. Consequently, compounds will be formed in regions which are considered to be dark, as a result of which undesired insertion of a specific amino acid
35 can take place.

The present invention relates to a test device which solves the miniaturisation problems described above and is suitable for use for bio- and/or immunochemical tests such as ELISA and tests in which peptide syntheses are used, for example the PEPSCAN as described above.

The present invention relates to a test device which comprises a plate containing a multiplicity of wells, which is characterised in that the wells have a volume within the range of 0.1-20 μ l. The dimensions of the wells will be chosen depending on the price and availability of the samples and reagents to be used. In general, wells which are as small as possible will be preferred and, therefore, the present invention preferably relates to a test device in which the wells have a volume within the range of 0.1-5 μ l.

Entirely contrary to expectations, it has now been found that making the wells smaller has no adverse consequences for the efficient rinsability thereof. It has been found that the rinsing times required in order to obtain good rinsing are shortest if the ratio between the depth of the wells and the diameter thereof is less than 1:1. Therefore, a test device comprising a plate containing a multiplicity of wells, characterised in that the wells have a volume within the range of 0.1-20 μ l, and that the ratio between the depth of the wells and the diameter thereof is less than 1:1, is very suitable. A test device according to the invention for which the ratio between the depth of the wells and the diameter thereof is less than 2:3 is preferred.

Figures 1 and 2 show the results of tests in which the rinsability of various test devices was investigated. The test devices had wells of equal diameter (2 mm) but of different depths. The rinsability was investigated on a shaking machine at speeds of, 47 and 40, respectively. The depth of the well in mm is plotted against the time in minutes needed to properly rinse the well.

The invention is preferably aimed at a test device in which the wells have a diameter of 1.0-4.0 mm, a diameter of 1.0-2.0 mm being preferred. The choice of the dimensions of the wells will depend on the desired specific test for which the test device is to be used. The smaller the diameter, the smaller the required volume of the sample.

In connection with the desired good rinsability, it is also preferred that the wells have a shape such that a vertical cross section of the wells is essentially U-shaped, the transition between legs and base of the U being gradual. Preferably there are no sharp angles in the well.

A number of suitable shapes of wells are shown in Figure 3.

The U shape in which the angle between base and legs is perpendicular is preferred for photometric determinations in which measurement is carried out under and through the plate.

The test device according to the invention will preferably be a plate containing wells separated by material barriers with a width of 1.0-5.0 mm, preferably by material barriers with a width between 1.0 and 2.0 mm. The material barriers must be sufficiently wide to prevent reagents
5 flowing over from one well to another. Specifically, the material barriers must be sufficiently wide when DMF is used as solvent, as is frequently the case in peptide synthesis. This is because DMF is known to have a high creeping capacity.

The test device according to the invention will comprise a plate
10 containing 5-20 wells per cm^2 , preferably 10-15 wells per cm^2 .

Furthermore, the test device will comprise material to which peptides, proteins and other biochemical molecules, such as hormones and polysaccharides, are able to adhere. For test devices suitable for tests with peptide synthesis, such material will preferably be material to which
15 peptides and proteins are able to adhere, such as polyethylene or polystyrene.

Other suitable examples of materials which can be used in a test device according to the invention are polypropylene and polycarbonate.

The choice of the material for the test device will also depend on
20 the reagents to be used in such a test device and on the detection method. In the case of photometric analysis through the bottom of the test device, for example, at least the bottom of the wells will have to be composed of transparent material. In the case of tests where DMF is used as solvent, it will not be possible to use a polystyrene test device because DMF is too
25 aggressive.

A preferred embodiment of the test device will be provided with a means for recording information, for example a bar code or a magnetic strip. The test device can be provided with data relating to the test it is intended to carry out, or which has been carried out, such data for exampl
30 relating to reagents or samples which have been used. The test device can also be provided with markings which indicate the coordinations of wells in the test device.

Figure 4 shows a top view of an example of one embodiment of the test device according to the invention.

35 A cross section is shown in Figure 5.

As already mentioned in the preamble, the present invention is also aimed at a method for carrying out (bio- and/or immuno)chemical tests, in which a test device according to the invention is used. In general, a test device according to the invention can be used in the same tests as the

known microtitre plate. It is now possible to carry out existing methods using much smaller amounts of sample and reagents; so-called mini-tests are now possible. It is possible to reduce the amount of sample used by a factor of one hundred. It is now possible to use 2.5 µl instead of 250 µl samples per well. Use of the test device according to the invention now makes mass screening of population groups much more attractive because much less blood is required from the donor and much smaller quantities of reagents are required.

Another great advantage of the miniaturisation of the methods by use of the test device according to the invention lies in the fact that the existing chemistry does not have to be modified. In this context consider the great advantage, for example, in the case of automated processes, such as the PEPSCAN. The test device is particularly suitable for use in methods in which large numbers of samples have to be used. A mini-ELISA and mini-PEPSCAN in which a test device according to the invention is used are suitable examples of the method according to the present invention. The advantage of a mini-method according to the invention is that the test can be carried out with sample amounts of less than 20 µl. It is readily possible to use sample amounts of less than 5 µl in a mini-method according to the invention.

The present invention is also aimed at a metering device suitable for simultaneously introducing equal volumes of reagent into different wells in a test device according to the invention. A metering device according to the invention can be used in order to carry out as efficiently as possible immuno- and/or biochemical tests in which a test device according to the invention is used. In this context, consideration is given to optional automation of certain methods according to the invention.

If a predetermined equal amount of reagent has to be introduced simultaneously into a number of wells, it is possible to use a metering device according to the invention, said device being provided with projections having dimensions and mutual spacings such that individual projections can simultaneously be positioned in or above wells of a test device according to the invention. With a metering device of this type, all wells can simultaneously be provided with equal volumes of reagent if the position of the projections is such that this essentially corresponds to the position of the wells in the test device according to the invention.

One embodiment of the metering device and the test device is shown in Figure 6.

If not all, but only a certain number, of wells in the test device have to be filled, a metering device can be used which has projections which simultaneously can be positioned above or in the selected wells.

In Figure 7 the darker wells are the selected wells. The projections of the metering device are located on the metering device in such a way that they can simultaneously be positioned above or in the darker wells.

To this end, a metering device can advantageously be used in which the projections are fixed to the support or can be fixed in a pattern which corresponds to the pattern of the wells into which reagent has to be introduced.

Figure 8 shows an example of an embodiment of the metering device in which the projections can be fixed to a support.

The metering device can comprise projections which are fixed or can be fixed to a support in a way equivalent to the bristles of a brush (Figs. 6, 7 and 8).

A metering device in which the projections, like the teeth of a comb, are parallel to one another and are fixed (Fig. 9) or can be fixed (Fig. 10) at their tops to a support is also an embodiment of a metering device according to the invention which is very suitable. The number of projections can be less than or equal to the number of wells forming a row in the longitudinal direction of the test device. The number of projections can be less than or equal to the number of wells forming a row in the widthwise direction of the test device. The number of projections will depend on the pattern of wells of the test device into which reagent has to be introduced.

The projections of a metering device according to the invention can be integral with the support or can be detachable. The projections can be fitted on the support in such a way that the projections form a pattern which corresponds to the pattern of wells which have to be filled in the test device (see Fig. 7).

It is also possible to use a metering device in which more than one projection can be positioned above or in a well at the same time, if it is desired to simultaneously introduce more than one reagent unit, which is present on a projection, into a well.

Figure 11 shows a metering device in which two projections can be positioned simultaneously above or in each well.

Thus, the amount of reagent which is present on a projection can be taken as standard and metering devices can be used which have a group of projections above or in the well, depending on the ratio in which it is

desired to introduce reagents into a well. A group will comprise the number of projections which corresponds to the number of desired reagent units.

In the case of a metering device according to the invention, the projections can be hollow, but they can also be solid or closed at the bottom. The latter two possibilities are to be preferred when working with very small amounts of sample and reagents, because it is then possible to work with drops of reagent.

The present invention is also aimed at a method for carrying out a (bio- and/or immuno-)chemical test using a metering device according to the invention, in which method

- a) the projections of the metering device are provided with reagent, in such a way that essentially equal volumes of reagent are present on or in the individual projections of the metering device, and
- b) the metering device is then positioned in or above wells of the test device according to the invention, which wells are intended to be provided with reagent, each individual projection being located in or above a well at the same time, and
- c) essentially equal volumes of reagent are introduced into the individual wells of the test device, which wells it is intended to provide with reagent.

The invention also relates to a method of this type in which the projections of the metering device are simultaneously provided with reagent by immersing the projections in reagent.

The present invention is also aimed at a kit which comprises at least a test device and metering device according to the invention. Such a kit can comprise a number of metering devices in the various embodiments described above and can also comprise replaceable projections for such metering devices.

Example 1Miniaturised peptide synthesis

Miniaturised synthesis of a complete tripeptide net (8000 different peptides) was carried out using test devices according to the invention.

5 The test device used in this example resembled a credit card in size and was constructed so that it comprised 455 wells with a diameter of 2 mm and a maximum volume of 5 µl each. The test device was made of polyethylene. In order to make this solid carrier suitable for peptide synthesis the wells were treated via the method described by Geysen et al. (1984) previously

10 mentioned. The carboxyl groups of the polyacrylic acid were provided with a NH₂-group via a linking reaction of a linker t-ButylOxyCarbonyl-HexaMethyleneDiAmine (BOC-HMDA) in the presence of N,N-DicyclohexylCarbodiimide and N-HydrOxyBenzotriazole (DDC/HOBt). All these linking reactions were carried out in DiMethylFormamide (DMF).

15 After removing the t-butyloxycarbonyl group with TriFluor Acetic acid (TFA) a mixture of all twenty L-amino acids linked using the same method as used for linking the linker was used.

The total volume used in the linking reaction amounted to 3 µl for each well. Pipetting the required small amounts was achieved completely

20 automatically using a computer directed robot arm with a pipette installation (Hamilton MicroLab 2200). A special software program was written for this objective enabling two of test devices according to the invention described in this example to be filled per hour.

The linking time for each amino acid amounted to approximately 2 to

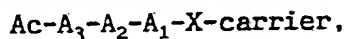
25 3 hours. The difference in linking time is caused by the reaction stopping when the reaction mixture has completely evaporated.

Subsequently after removal of the BOC-group with TFA the next amino acid was linked in the same manner after which the cycle was repeated twice more.

30 After the last linkage reaction and after removal of the BOC-group the terminal NH₂-group was acetylated with a mixture of acetic acid anhydride in DMF and TriEthylAmine in the ratio 2/5/1. The groups protecting the side groups were removed in a strong acid environment. In this instance BoriumTrisTrifluor acetic acid (BTT) in TFA (30 mg/ml) was used for two

35 hours at room temperature.

The total structure of the peptide was as follows:



wherein Ac represents an acetyl group, A_x represents a single amino acid and X represents the mixture of amino acids.

Example 2Elisa

The test devices according to the invention were rinsed with phosphate buffered saline (PBS, 3x10 min) before incubation of the peptides
5 with serum, after which the test devices according to the invention were precoated for 1 hour at 37°C with 10% horse serum/10% ovalbumine/1% Tween 80 in PBS (SuperQ) in order to prevent aspecific absorption of antibodies. The test devices according to the invention were completely submerged in the liquid.

10 Filling the test device wells with serum dilution can be carried out in two ways. If only a little serum is available the test devices can be filled using the robot arm mentioned in the previous example and when sufficient serum is available the test devices can be submerged in the serum and subsequently be wiped so that all the wells are simultaneously
15 filled.

Incubation of the test devices took place during the night at 4°C in air saturated with water, after which the test devices were washed three times with 0.05% Tween 80/PBS in order to remove antibodies that had not been bound. The test devices according to the invention that had been
20 incubated with serum were subsequently incubated for 1 hour at 37°C with an antibody conjugated peroxidase enzyme (1/1000 solution in SuperQ) by submerging the test devices in a solution comprising said enzyme. After this the test devices were rinsed with PBS, 3x 10 min. The presence of the second antibody was demonstrated with the substrate liquid ABTS (2,2'-
25 Azine-di[3-ethyl benzthiazoline sulfonate (6)]). In this instance it is also possible to use the two aforementioned methods to fill the wells, either using the robot arm or submerging the devices in the substrate.

CLAIMS

1. Test device comprising a plate containing a multiplicity of wells, characterised in that the wells have a volume within the range of 0.1-20 µl.
- 5 2. Test device according to Claim 1, characterised in that the wells have a volume within the range of 0.1-5 µl.
3. Test device according to Claim 1 or 2, characterised in that the ratio between the depth of the wells and the diameter thereof is less than 1:1, preferably less than 2:3.
- 10 4. Test device according to any of the preceding Claims, characterised in that a vertical cross section of the wells is essentially U-shaped, the transition between legs and base of the U being gradual.
5. Test device according to any of the preceding claims, characterised in that the diameter of the wells is 1.0-4.0 mm and preferably 1.0-2.0 mm.
- 15 6. Test device according to any of the preceding claims, characterised in that the wells are separated by material barriers with a width between 1.0-5.0 mm and preferably between 1.0 and 2.0 mm.
7. Test device according to any of the preceding claims, characterised in that the plate contains 5-20 wells per cm², preferably 10-15 wells per
- 20 cm².
8. Test device according to any of the preceding claims, characterised in that the wells of the plate are composed of material to which peptides, proteins and other biochemical molecules, such as hormones and polysaccharides, are able to adhere.
- 25 9. Test device according to any of the preceding claims, characterised in that the bottom of the wells is sufficiently transparent for carrying out photometric analysis.
10. Test device according to any of the preceding claims, characterised in that the plate is made from material to which proteins and/or peptides
- 30 are able to adhere.
11. Test device according to any of the preceding claims, characterised in that the plate is made from material selected from the group comprising polyethylene, polypropylene, polystyrene and polycarbonate.
12. Method for carrying out a (bio- and/or immuno)chemical test,
- 35 characterised in that a test device according to any of Claims 1-11 is used.
13. Method according to Claim 12, characterised in that the test carried out is a pepscan or ELISA.

14. Method according to Claim 12 or 13, characterised in that the test is carried out using sample amounts of less than 20 µl.
15. Method according to any of Claims 12-14, characterised in that the test is carried out using sample amounts of between 0.1 and 5 µl.
- 5 16. Use of a test device according to any of Claims 1-11 for carrying out a bio- or immunochemical test such as a pepscan or ELISA.
17. Metering device suitable for simultaneously introducing equal volumes of reagent into different wells of a test device according to any of Claims 1-11.
- 10 18. Metering device according to Claim 17, characterised in that said device is provided with projections which have dimensions and mutual spacings such that individual projections can simultaneously be placed in or above the wells of a test device according to any of Claims 1-11, intended to be provided with reagent.
- 15 19. Metering device according to Claim 17 or 18, characterised in that the projections, like the teeth of a comb, are parallel to one another and are fixed at their tops to a support.
20. Metering device according to Claim 17 or 18, characterised in that the position of the projections is such that said position essentially
20 corresponds to the position of the wells in the test device according to any of Claims 1-11.
21. Metering device according to any of Claims 17-20, characterised in that said device is provided with projections which have dimensions and mutual spacings such that, in each case, a group of projections is located
25 above a well.
22. Metering device according to any of Claims 17-21, characterised in that the projections are closed at the bottom.
23. Metering device according to any of Claims 17-22, characterised in that the projections are detachable.
- 30 24. Method for carrying out a (bio- and/or immuno)chemical test using a metering device according to any of Claims 17-23, in which method
 - a) the projections of the metering device are provided with reagent, in such a way that essentially equal volumes of reagent are present on or in the individual projections of the metering device, and
 - 35 b) the metering device is then positioned in or above the wells of the test device according to any of Claims 1-11, said wells to be provided with reagent, each individual projection or each group of projections being located in or above a well at the same time, and

c) essentially equal volumes of reagent are introduced into the individual wells of the test device, said wells to be provided with reagent.

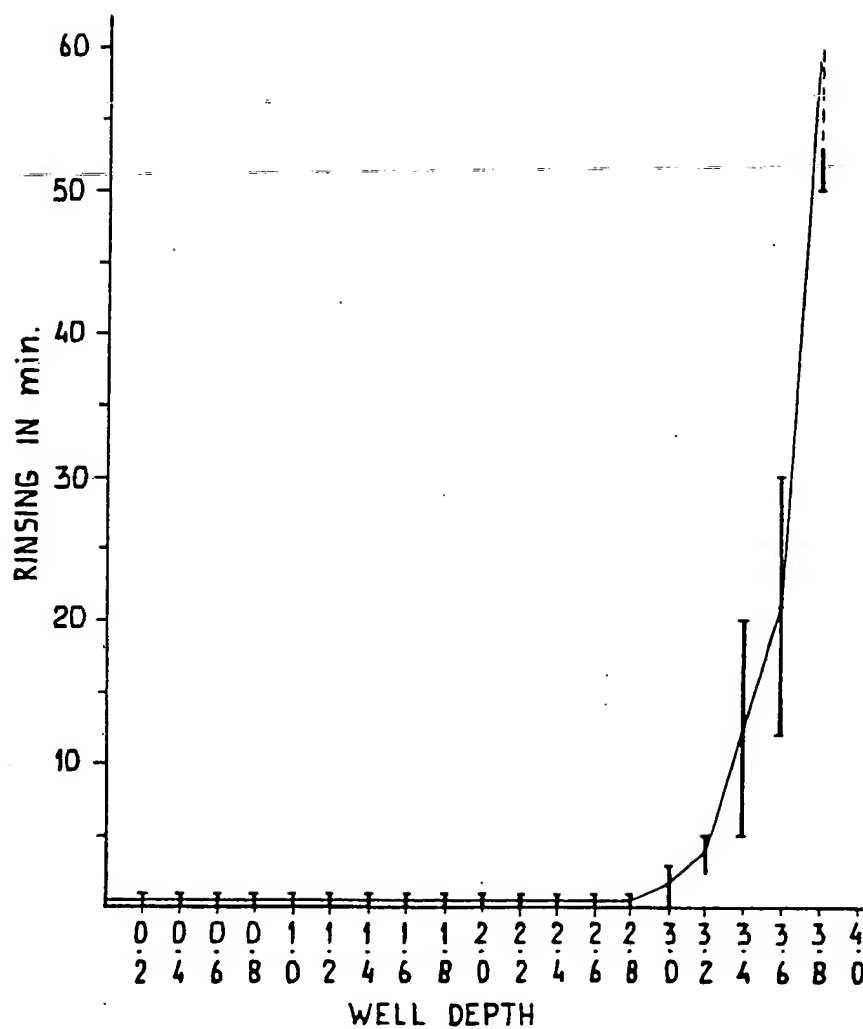
25. Method for carrying out a (bio- and/or immuno)chemical test according to Claim 24, in which method, in step a), the projections of the metering device are simultaneously provided with reagent by immersing the projections in reagent.

26. Kit which comprises at least a test device according to any of Claims 1-11 and at least a metering device according to any of Claims 10 17-23.

27. Kit according to Claim 26, which comprises detachable projections for the metering device.

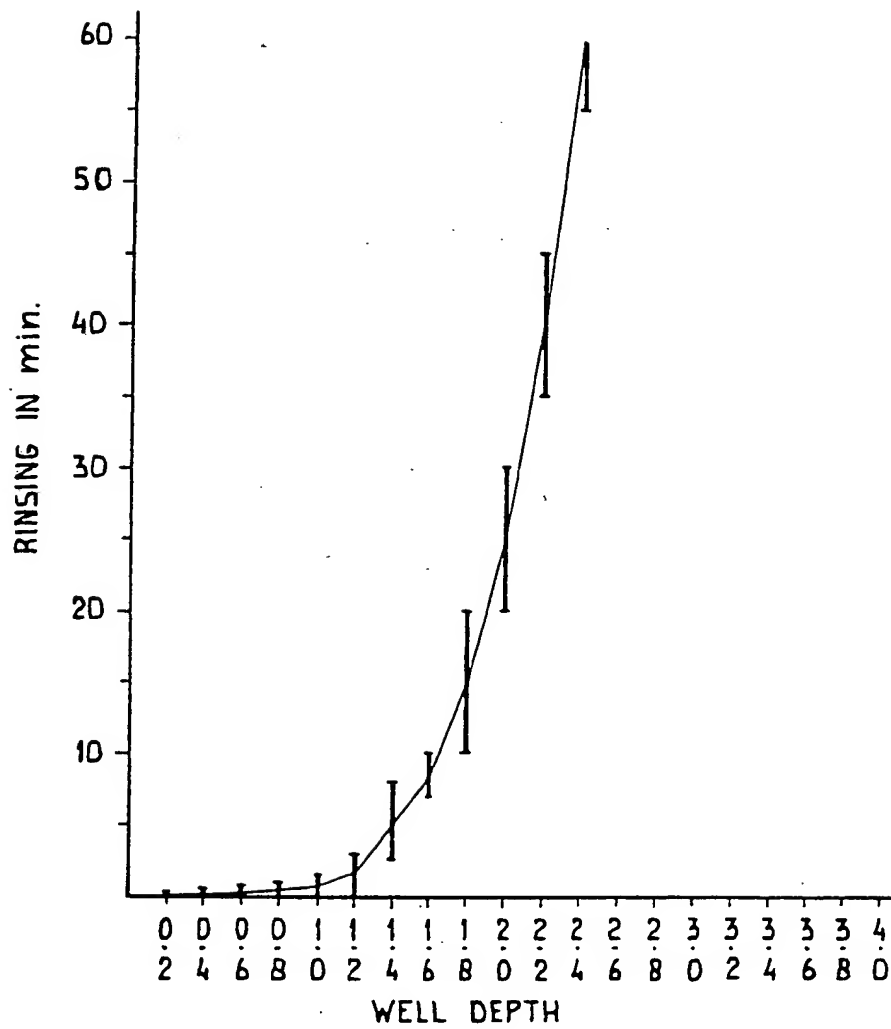
1/5

fig-1



2/5

fig-2



3/5

fig-3

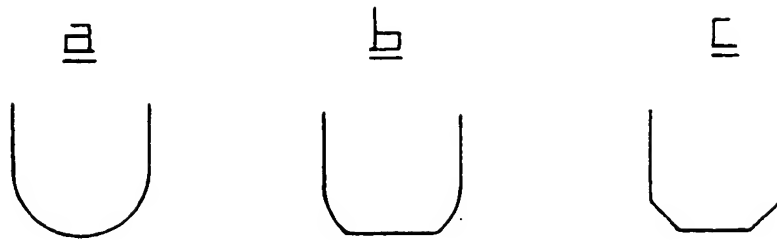


fig-4

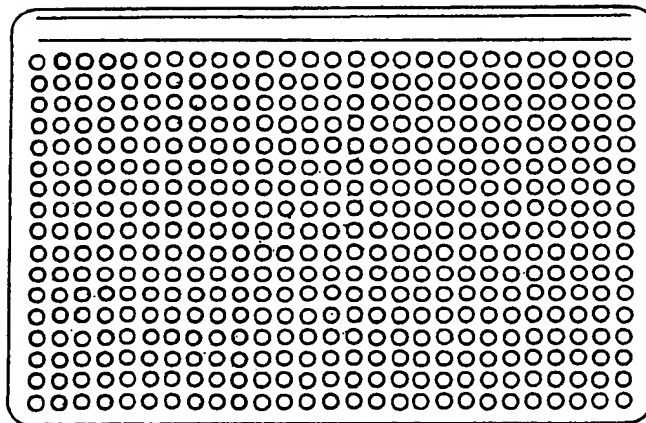


fig-5



4/5

fig-6

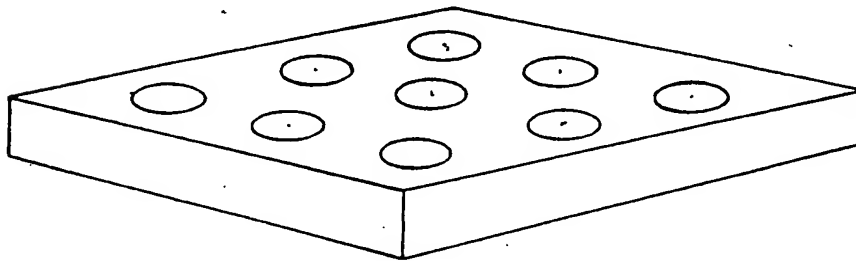
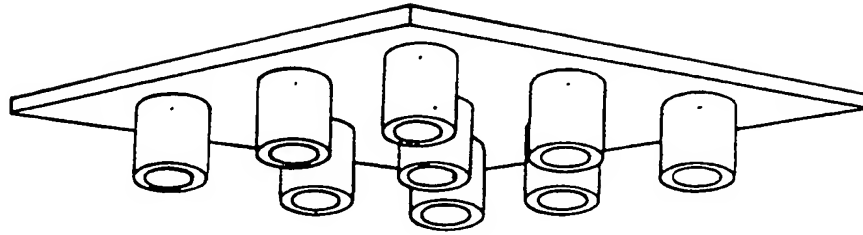
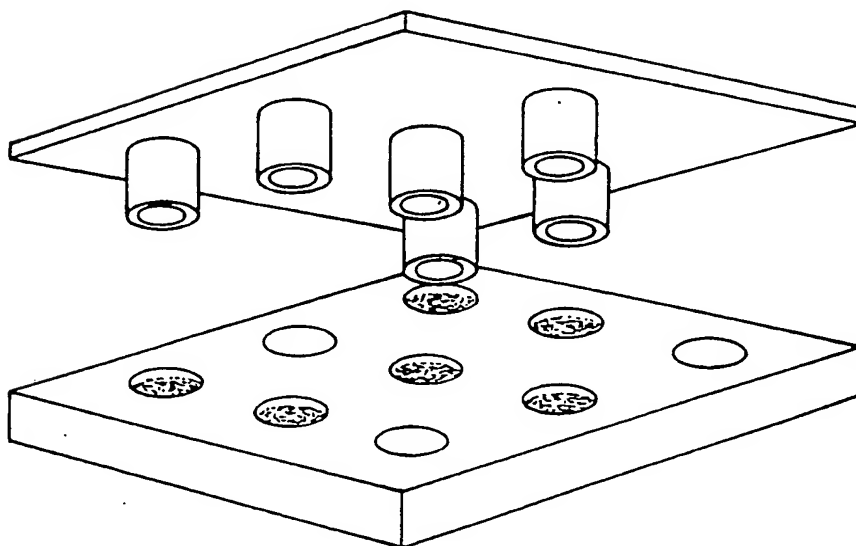


fig-7



5/5

fig - 8

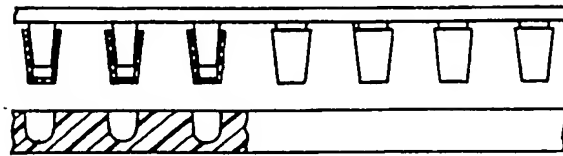


fig - 9

a

b

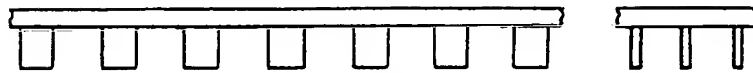


fig - 10

a

b

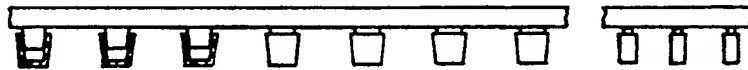
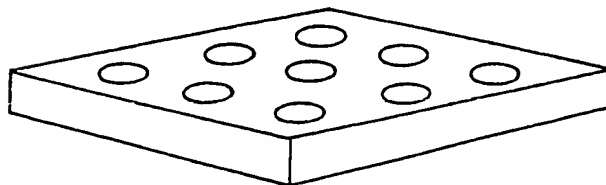
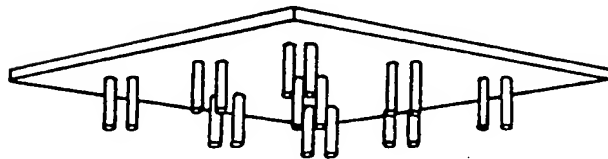


fig - 11



INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 92/00213

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 B01L3/00; G01N33/53		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	B01L	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	WO,A,9 106 859 (R.M. JAFFE) 16 May 1991 see page 16, line 6 - page 17, line 19 ----	1,3, 8-14,16
A	EP,A,0 018 435 (W. STÖCKER) 12 November 1980 see page 4, line 7 - line 13 see page 13; line 10 - line 13 ----	1,7,9,12
A	FR,A,2 383 442 (INSTITUT PASTEUR) 6 October 1978 see page 2, line 11 - line 33; figures 6-10 ----	1,2, 12-27
A	DD,A,107 783 (A. HORN ET AL.) 12 August 1974 see page 4 ----- -/--	1,12-17
<p>⁹ Special categories of cited documents : ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
24 MARCH 1993	08.04.93	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	HODSON C.M.	

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	
A	US,A,4 200 613 (C.P. ALFREY ET AL.) 29 April 1980 see figures 2-6 ---	1,17-23
A	EP,A,0 347 579 (MESSERSCHMITT-BÖLKOW-BÖHM GMBH) 27 December 1989 ---	
A	US,A,4 735 778 (N. MARUYAMA ET AL.) 5 April 1988 -----	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

NL 9200213
SA 68285

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 24/03/93

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A-9106859	16-05-91	AU-A-	6647490	31-05-91
		CA-A-	2070408	26-04-91
		CN-A-	1051791	29-05-91
		EP-A-	0497870	12-08-92

EP-A-0018435	12-11-80	AT-T-	6548	15-03-84
		US-A-	4339241	13-07-82

FR-A-2383442	06-10-78	CH-A-	621410	30-01-81
		JP-A-	54033780	12-03-79
		NL-A-	7802137	12-09-78
		US-A-	4162896	31-07-79

DD-A-107783		None		

US-A-4200613	29-04-80	DE-A,C	2824164	15-03-79
		GB-A-	1585948	11-03-81

EP-A-0347579	27-12-89	DE-A-	3818614	07-12-89
		DE-A-	3825907	01-02-90
		DE-U-	8817007	02-10-91

US-A-4735778	05-04-88	JP-A-	62047533	02-03-87
		DE-A,C	3629272	05-03-87
		GB-A,B	2181843	29-04-87
